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1995 Clark Fork River
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 diversions project

**CLARK FORK RIVER
IRRIGATION DIVERSIONS PROJECT
FINAL REPORT**

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Missoula County Conservation District

**CLARK FORK RIVER
IRRIGATION DIVERSIONS PROJECT
FINAL REPORT**

**December 1995
P11372.00**

**Prepared by
Acres International Limited
Suite 500, 10201 Southport Road S.W.
Calgary, Alberta
T2W 4X9**

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Appendix A Site Photos

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1 Introduction

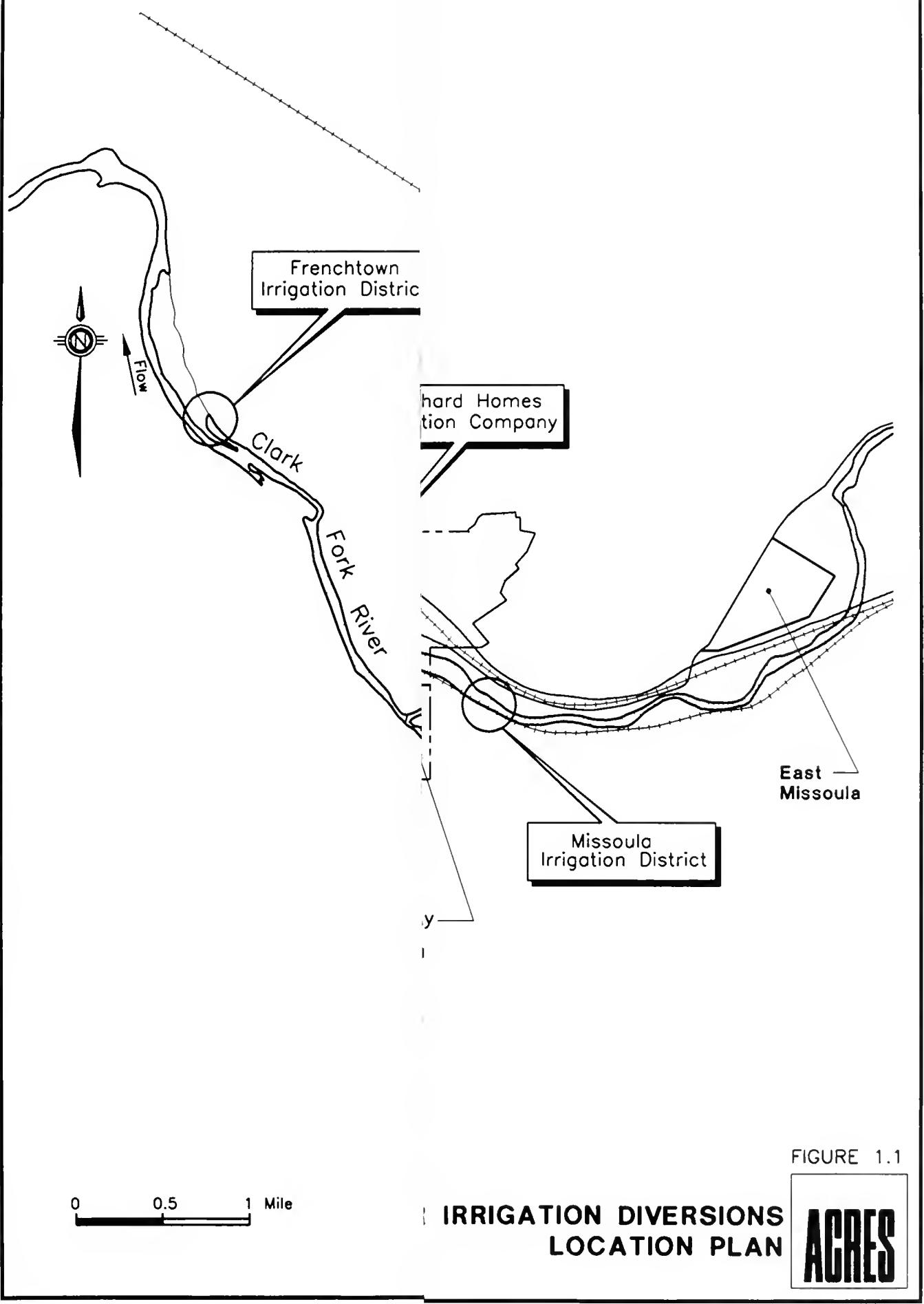
1 Introduction

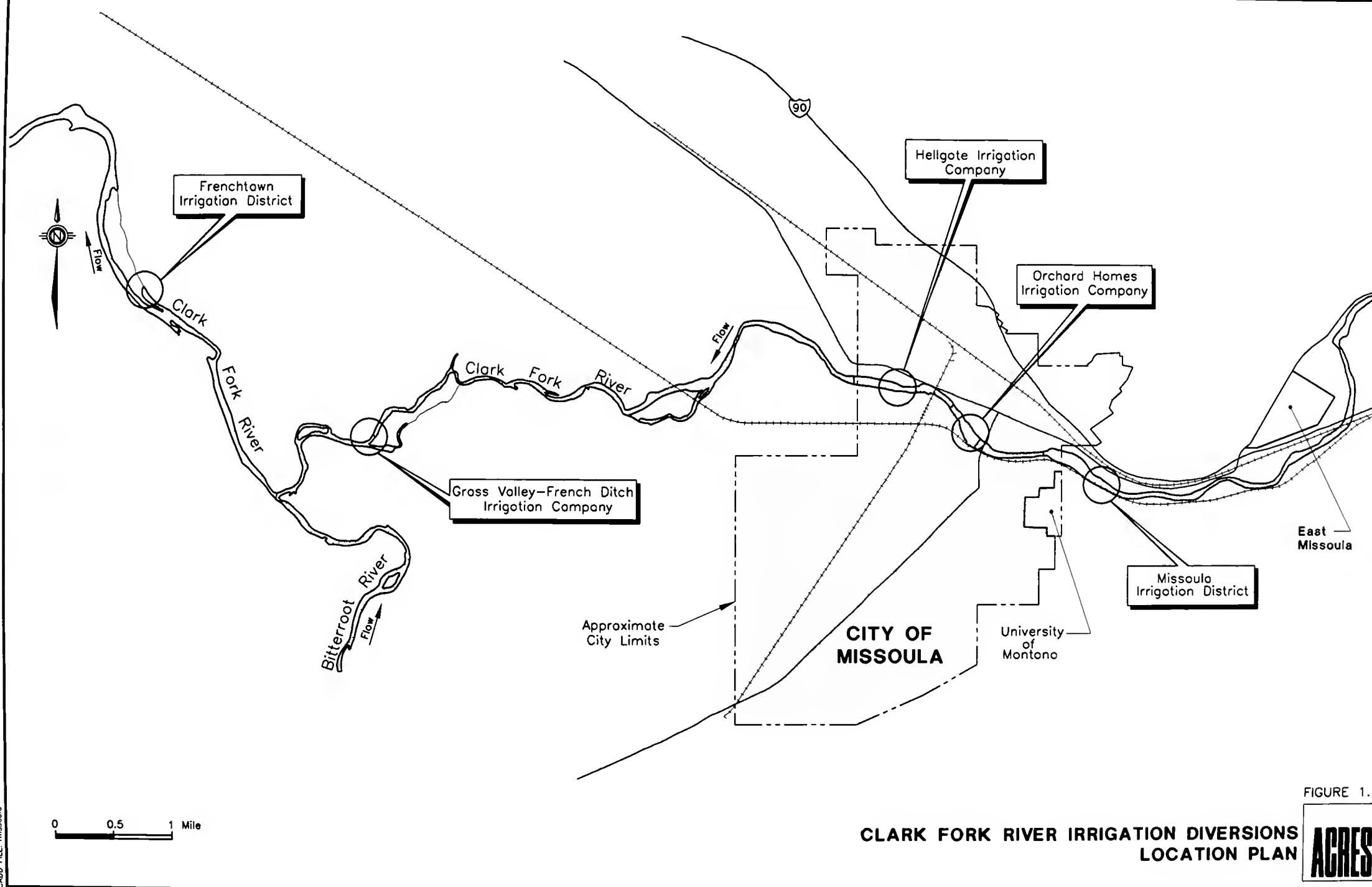
The Clark Fork River supplies water to five public or private irrigation districts within a 4 mile radius of Missoula, as shown on Figure 1.1. Each organization has some type of independent method of diverting water to their system. Four sites utilize gravel or rock berms in the main channel to check up the water depth during low flow periods. This practice is becoming increasingly controversial from an environmental and recreational standpoint, and each berm requires periodic repair or replacement, at varying intervals, due to damage during spring runoff. Three of the sites are located in urban Missoula, and are easily visible by residents and recreational users. A typical irrigation diversion system and its components is illustrated on Figure 1.2.

Acres International Limited was retained by the Missoula County Conservation District (MCCD) in July 1995 to perform the Clark Fork River Irrigation Diversion Project. The purpose of this project was to investigate alternatives for diverting flow into the inlet irrigation facilities, and to address other operational difficulties associated with the diversions. Recreational, aesthetic, habitat and legal considerations were reviewed. Additional design effort will be required to further develop the selected alternatives.

As the Missoula area grows, there will be increased pressure on all types of existing resources, particularly the local infrastructure which includes roads, streets, utilities, parks, trails, recreation areas and irrigation facilities. With this increased pressure will come public scrutiny of all public and quasi-public actions relative to these resources. This trend is already evidenced by the increasing public interest in projects of all types.

The three 'urban' diversion sites are within the boundary of the Missoula Redevelopment Agency. Therefore, any capital improvements (beyond routine maintenance), especially recreation and/or aesthetic improvements, would be subject to MRA review. In 1989, the MRA commissioned "The Missoula Downtown Riverfront Plan - 1990" in order to promote the enhancement and preservation of the City's riverfront heritage and to articulate a series of goals, policies and strategies by which a Riverfront Park Concept could be implemented. Adopted as part of the Missoula City/County Comprehensive Plan, the Riverfront Plan addresses the important role that the Missoula County Conservation District and the individual irrigation companies have in the future use and enhancement of the Clark Fork River in Missoula. Specifically, it lists goals and strategies which support the District's role in improving the operation, aesthetics and safety aspects of the diversions. It also suggests a number of recreation and access improvements which could involve the District.





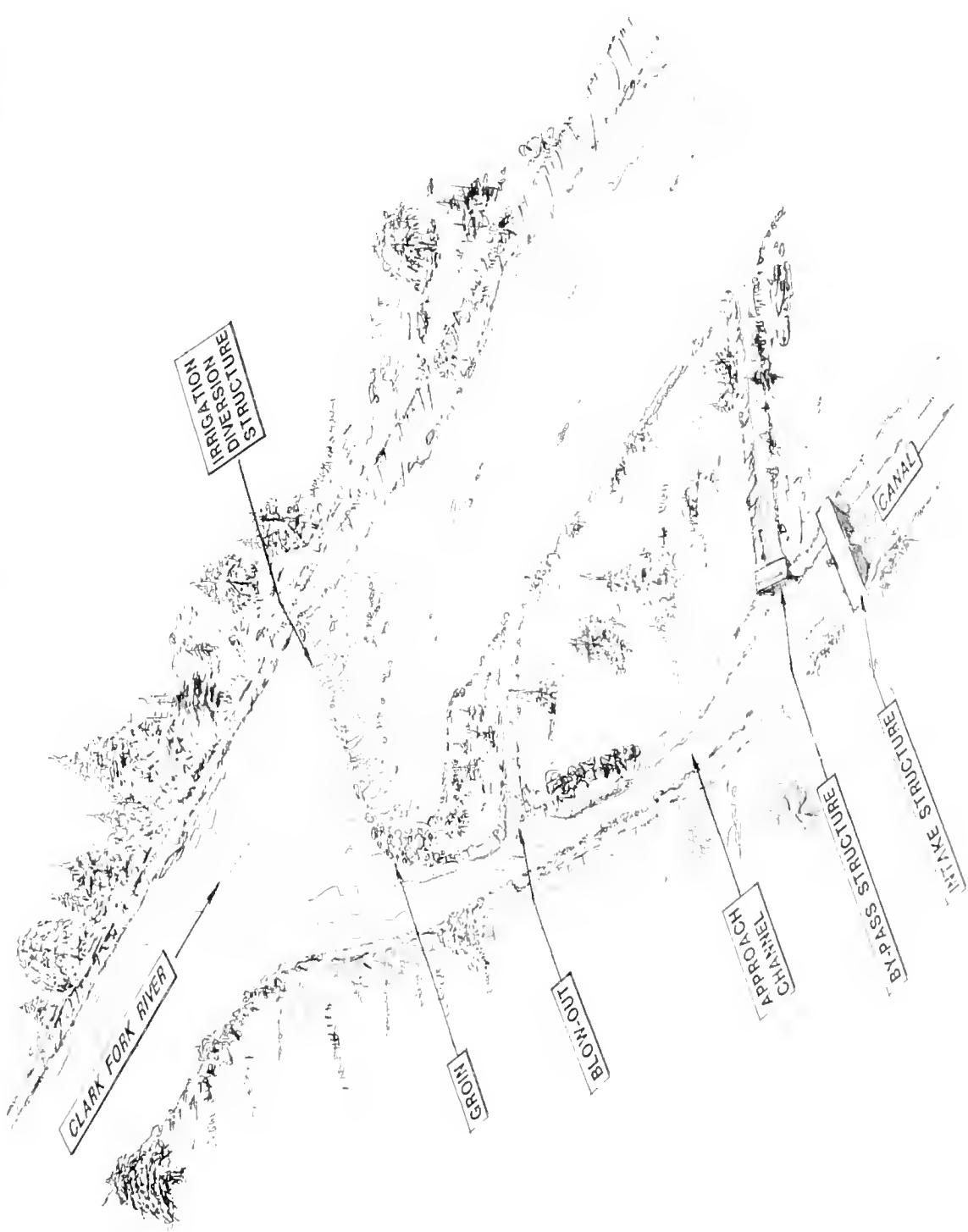


FIGURE 1.2

CLARKFORK RIVER IRRIGATION DIVERSIONS
TYPICAL IRRIGATION DIVERSION





FIGURE 1.2

**CLARKFORK RIVER IRRIGATION DIVERSIONS
TYPICAL IRRIGATION DIVERSION**



The upper site (Jacobs Island Park) is also under the jurisdiction of the Missoula Parks and Recreation Department. In addition, the Riverfront Trail, John Toole Park, and the Clark Fork Natural Park are all administered by the Department for maintenance and operations.

As alluded to above, activities involving the irrigation companies can no longer be done in isolation. Whether their actions involve bulldozing rock in the river or other activities, they are becoming increasingly subject to public scrutiny. Yet there seems to be little public understanding about the function of the ditches. Given the manner in which the diversions and the ditches affect the public as a whole, this approach is no longer appropriate.

The first task of the project was to perform on-site inspections of the diversion sites. These reconnaissances were performed July 12-13 with representatives from MCCD, Acres, Michael Schwartz & Associates, Kent Watson & Associates, and the respective irrigation companies. A description of each site inspection is described in the following section.

Other tasks performed as part of this study are as follows:

- Research and compilation of available hydraulic, recreation, aesthetic, habitat and legal data
- Air photo photography of all diversion sites
- Photogrammetric topographic mapping of the three urban diversion sites
- Investigation and development of operational and physical improvements to improve river diversion during low flow
- Address recreational, environmental and legal concerns related to the existing diversions and proposed alternatives
- Estimation of costs for proposed improvements
- Development of action plan of improvements considering present budgetary limits

These tasks are discussed or reviewed in other sections of this report and have been grouped by irrigation company or district.

This study focused on assessing the feasibility of simple, low cost structures for improvements to the irrigation diversion structures in the river. The Clark Fork River is a relatively large, swiftly flowing river with significant ice effects and unfortunately there is no easy, low cost alternative that is possible.

2 Site Reconnaissances

2 Site Reconnaissances

2.1 310 Activities and River Discharges

Recent activities by the various irrigation companies which required SB-310 applications are summarized below in Table 2.1.

TABLE 2.1
CLARK FORK RIVER - SB-310 APPLICATIONS

Year	Company or District	Activity
1977	Frenchtown	Activity not specified
1979	Frenchtown	Activity not specified
1982	Frenchtown	Repair dike
1983	Hellgate	Stabilize spillway
1985	Missoula	Ditch repair
1985	Frenchtown	Diversion
1986	Grass Valley	Diversion
1986	Frenchtown	Rechannel
1987	Frenchtown	Divert Water
1988	Frenchtown	Install diversion
1988	Grass Valley	Riprap
1988	Hellgate	Repair diversion
1990	Frenchtown	10 Yr. Plan of Operation
1990	Grass Valley	Replace headgate
1992	Frenchtown	Repair dike
1992	Hellgate	Build up ditch
1994	Hellgate	Maintain weir
1994	Grass Valley	Repair for cable
1995	Grass Valley	Dike

Table 2.2 summarizes the mean monthly discharges for the Clark Fork River during the irrigation season (April to September).

TABLE 2.2
CLARK FORK RIVER
MEAN MONTHLY DISCHARGES (cfs)

Year	Apr	May	Jun	Jul	Aug	Sep
1976	7,188	17,240	10,790	4,703	2,543	2,103
1977	1,956	2,607	2,149	1,101	774	965
1978	5,048	8,519	9,100	5,081	1,917	2,226
1979	2,995	9,565	6,717	2,123	1,258	1,283
1980	2,963	10,730	11,470	4,075	1,541	1,715
1981	3,083	11,420	9,897	3,367	1,436	1,317
1982	3,830	10,500	13,560	6,391	2,007	1,792
1983	2,356	5,906	6,234	4,068	2,027	1,884
1984	3,458	7,065	9,278	3,360	1,742	1,802
1985	3,370	6,570	3,997	1,203	1,208	1,773
1986	4,903	6,409	6,173	2,169	1,123	1,648
1987	2,469	4,002	2,288	1,434	963	858
1988	2,268	4,480	3,229	1,197	627	694
1989	5,697	8,099	6,016	2,239	1,601	1,622
1990	5,739	6,311	7,827	2,795	1,509	1,235
1991	2,613	7,259	8,543	3,080	1,236	1,193
1992	2,627	3,813	2,122	1,504	788	858
1993	2,451	7,031	4,929	3,410	2,369	2,236
1994	3,988	5,809	3,387	1,489	861	793
1995	2,205	5,841	8,227	3,600	1,525	1,488

An analysis was performed reviewing the SB-310 applications for in-river activities versus river discharge. In general, work has been performed during lower than normal discharge periods. Low river discharge years occurred in 1977, 1985, 1987, 1988, 1992 and 1994 and SB-310 activities occurred in the majority of these years.

The only SB-310 application for work in the river after a high river discharge occurred in 1983 by Hellgate Irrigation Company, after relatively high discharges occurred in May and June 1982.

This comparison of discharges and SB-310 applications agrees with the comments received during the site visits. It also confirms expectations that irrigation diversions function adequately except during unusually low discharge years when discharges in the Clark Fork River during the latter part of the irrigation season drop below about 900 cfs. These low river discharges have occurred five times in the last twenty years.

2.2 Missoula Irrigation District Site Reconnaissance

The team inspected the Missoula Irrigation District site on July 12, 1995. Present were Sarah Babcock (MCCD), Lyle Berg, Chairman of the Missoula Irrigation Company, Lance Bendiak and Don Roberts of Acres International, Mike Schwartz and Kent Watson. Mr. Berg mentioned that the District provides irrigation water from May 1 to October 1, and that it serves 4000 "units", with a unit varying in size from one to 34 acres; typically a unit is one acre. The District is public, and is supported by local taxes. He also stated that ingesting water into the ditch is rarely a problem, and that he has not experienced any low flow conditions requiring rationing over the past 20 years.

The irrigation channel was originally constructed in the late 1800's, and has "first rights" to divert water from the Clark Fork River. The District has also been involved in defending their continued operation against significant public opposition generated from a recent drowning accident in their system. Mr. Berg felt that sufficient water depths existed in the river channel for diversion of irrigation water during the low flow periods.

Concern was expressed regarding canal bank erosion near the headgate structure. A low weir consisting of concrete rubble and other debris exists adjacent to the headgate, and is also in poor condition. It failed in 1994, and presently exhibits significant leakage. A Corps of Engineers representative has recently inspected the area and recommended replacing the rubble with large riprap combined with smaller rockfill. He also mentioned that a concrete overflow structure would be an acceptable alternative, with an approximate installed cost of \$100,000. Items to be assessed during the study include replacement of the low weir near the headgate structure and the legal and engineering

implications of a combined supply system for the Missoula Irrigation District and Orchard Homes Irrigation Company.

This site was visited on May 31, July 11 and July 16 by Kent Watson. Of the three urban sites, this one receives the heaviest recreational use. Its proximity to Jacobs Island Park, the Van Buren pedestrian/bicycle bridge and pathway, and the Riverfront Trail which leads into the Kim Williams trail all combine to attract a large number of users. Public parking is readily available nearby. During the summer season, the area around the intake structure and bypass structure are especially popular. On each visit, the following activities were noted:

- Swimming in the canal between the bridge and overflow "blowout", includes individuals (mostly boys and young men) dropping from bridge and/or from rope swing(s) hanging in nearby cottonwood tree;
- Wading by younger children (3 to 6 yrs.) from Jacobs Island Park-side amongst the rocks and debris of overflow "blowout";
- Picnicking and hanging-out on the grass of the park adjacent to overflow; and
- Casual walking and biking onto the intake and bypass structure, mostly from the Riverfront Trail. (Some kids were seen picking their way across the overflow to these structures.)

The rope swing noted above continues to be a liability concern with the Missoula Parks and Recreation Department. Even though the staff has removed the rope swing on many occasions, it usually re-appears within hours; they now no longer remove it. Even so, their attorney continues to express concern over the City's liability exposure. To date no claims or law suits have been filed for accidents or injuries in this location.

While no claims or law suits have been filed, there are a number of possible liability concerns which need to be addressed. Of particular concern is the open sluiceway below the stop boards of the bypass structure. At high water levels, the speed and volume of water here is a potential hazard since there is no grate, railing or enclosure to prevent anyone from slipping off the walkway and being quickly swept into the main river channel.

This site is quite open and visible from a number of heavily-used areas. For instance, patrons of Goldsmith's deck and/or the River Walk along the north bank are subjected to a direct view of the overflow "blowout", with its concrete and driftwood debris, and the

adjacent concrete "box" bypass structure. Even though the overflow is unattractive, it is not as jarring and visually offensive as the bypass structure. This is probably the least attractive view of the area, since the full extent of the box structure is visible, regardless of the water level in the canal.

Due to its heavy human use, it is doubtful that any modifications to the structures and/or overflow would have any adverse impacts on wildlife or habitats at this site.

Finally, it should be noted that the area along the approach channel from the river diversion facilities to the bike bridge presents no apparent recreation, aesthetic or habitat concerns. Due to its steep banks and heavy vegetation, the approach channel is not an attractive recreation element. While some might object to the diversion, it is very low key and non-obtrusive, especially when compared to the other diversions.

2.3 Orchard Homes Irrigation Company Site Reconnaissance

The site reconnaissance team met at 1:00 p.m., on July 12, 1995, near the Milwaukee Road Station. No representative from the Orchard Homes Company was available.

S. Babcock mentioned that this irrigation company, in comparison to other urban companies, served the least number of users. She said that sandbags are occasionally placed from the end of the existing gravel berm to an adjoining pier on the Higgins Ave bridge to check up the water elevation, and that flows do not have to be much lower than those visible to create supply problems for the channel.

The Orchard Homes channel provides a natural water barrier for an adjoining island that is leased as a wildlife sanctuary. One alternative that will be investigated for this study will be supplying the Orchard Homes canal with water diverted from the upstream Missoula canal, and abandoning the existing diversion and approximately 750 ft. of channel. If this option is implemented, the impact of eliminating the water barrier for the island should be addressed. Other items to be investigated include lateral leakage from the channel and sufficient checking of the water depth at the headgate facilities.

This site was visited on May 31, July 11 and July 17 by Kent Watson. This diversion provides no particular recreational attraction to this area since the main uses here are pedestrians and bicycles on the Riverfront Trail and people relaxing on the lawn in front of the Boone and Crockett Club building. Since the water level is down a steep bank several feet from the trail and bank top, there is really no water access in this area. Also,

the presence of a fairly thick screen of vegetation along this bank obscures a substantial portion of the river and approach channel, particularly west of the main buildings

The most obvious aesthetic and liability concern is the presence of the remainder of the original diversion structure directly opposite Caras Park on the north bank. Apparently there are protruding sections of concrete rubble and steel bars which could cause serious injury to unsuspecting boaters, since these are not readily visible at high water. In addition, the value of the rather unattractive diversion created by the dumped material below the Higgins Bridge needs to be assessed.

Downstream of the Boone and Crockett Club, there are several places where steel shapes and concrete rubble have been placed along the bank of the approach channel or in openings or "blowouts" that return water to the main river channel. Fortunately, the heavy band of vegetation largely obscures some of these areas. An approximately 50-foot long opening directly opposite the "Clark Fork Natural Park" sign does provide a clear view of some of the remnants of the concrete and steel mentioned above. The intake structure is hidden below the relatively new bridge in this location. The overflow from the bypass structure creates an attractive stream running back into the main river. As with other similar streams, it provides for pleasant and easy water access for children who want a relatively safe place for water play. This stream also provides some protection to wildlife that inhabit the island as well as providing additional riparian habitat along its banks.

2.4 Hellgate Irrigation Company Site Reconnaissance

The team inspected the site at 3:15 p.m., on July 12, 1995. A representative from the Company was not present. A noticeable berm exists to check up the water level in the main river channel, and significant repairs or rock placement is performed about every five years. Large angular rock was placed last fall, and appears to be intact. Remnants of a wooden floor dam installed in 1955, and destroyed by ice the same year, were also visible. S. Babcock mentioned that some survey information is available for the site, and the Department of Fish, Wildlife and Parks has not previously objected to the work on the berm and has provided some technical advice. Numerous 'phone calls are usually received from concerned citizens when work is performed in the river. The headgate facilities located downstream are in satisfactory condition. Items to be investigated include river diversion structures (capital cost less than \$400,000) and minor "blowout" leakage from the canal.

This site was visited on May 31, July 11 and July 18 by Kent Watson. While the river diversion is the most obtrusive and least attractive of all sites, this site may have the

greatest potential for recreational use, even though it apparently receives little such use now. Also, this stretch of the Clark Fork River has the greatest visibility of any portion within the City, by virtue of its proximity and exposure to some 500 feet of West Broadway, a major east-west arterial street.

Missoula Redevelopment Agency (MRA) is planning a variety of improvements for this area. As result of a meeting with Geoff Badenoch, Executive Director of MRA, the following was stated

- Carter & Burgess Engineers are completing contract documents for a paved 10'-12' wide pedestrian/bicycle trail, passing in front of Eagle Watch Estates, which will connect the end of Ashland Street to the end of California Street. In addition, the plans call for benches, trash containers and landscaping. Construction could occur this fall or early next spring, depending on timing and coordination with the City Street Department.
- MRA considered the concept of improved access to the in-board side of the intake structure (directly in front of Eagle Watch), but did not proceed due to cost limitations at this time. They remain open to the idea.
- Erica Brown, an intern with MRA, is in the process of completing a site map, detailed inventory and investigation of the island immediately downriver of the river diversion structure. The purpose of her work is to provide MRA with enough information on whether they should acquire the island and improve it for recreation or other uses.
- MRA is awaiting funding from the state (CTEP funds) and completion of relocation plans before acquiring and demolishing the second-hand stores and barber shop between W. Broadway and the river, at the foot of Nora Street. This action will likely occur within the next 12 months.
- The City Engineering Office has plans underway to provide walkway improvements along the riverside of W. Broadway. According to Mr. Badenoch, there should be a trail complete from the MRL trestle to California Street within one to three years.

In light of the above information, the site has been examined in considerable detail. There is great potential for recreation at this site. For example, the unimproved access road at the end of Ashland Street crosses the approach channel on a small bridge, descends the dike abruptly, then fords the small stream resulting from the "blowout" and

proceeds on to the island. As with the side creek at the Orchard Homes site, above, this stream provides easy, direct and relatively safe water access. There is evidence of some transient camping occurring here. While MRA has no plans now for this area, this could change if they decide to acquire and improve the island.

The intake and bypass structures for the canal are directly in front of Eagle Watch Estates, a seniors residential facility. While the structure is large, it is in fairly good repair and not unattractive, given its relationship to the bank and most readily accessible viewpoints. Currently, the amount of water being released from the bypass back into the river creates quite a scene. The rushing water sound from this structure can be heard for a considerable distance. The stream of white water gushes straight out from the structure into a relatively calm lake or afterbay which is separated from the main river by another island. According to Mr. Badenoch, some of the residents of Eagle Watch want improved access to this point. As noted above, MRA has not rejected this idea and such an idea should be considered.

In addition to the proposed pathway, the City and the Lions Club have completed basic improvements (irrigated turf and trees) to the new Downtown Lions Park which lies along the irrigation canal between Eagle Watch Estates and the foot of California Street. The western half of the turf area slopes down towards the canal, coming within about four vertical feet of the water level. A strip of weeds and vegetation, several feet wide, separates the turf area from the canal.

The general aesthetic aspects of this diversion have already been discussed briefly. While the diversion structure in the river is quite obvious, it is not obtrusive. It is most visible at the north end where large boulders protrude to form the corner of the structure. Since the river descends fairly rapidly here, the structure's presence creates white water for some distance downstream. As noted above, any changes or improvements here will have to be sensitive to the area's high visibility.

While there are some piles of driftlogs and other wood along the edge of the canal below the diversion, these are not offensive. Between the Ashland St. bridge and the intake structure, there are two places where large pieces of concrete rubble have been placed along the bank. Since they are mostly on the well-vegetated bank, and not protruding above it, they are not too much of an aesthetic problem.

The MRA inventory of the adjacent island will make findings regarding any wildlife and/or habitat issues there.

2.5 Grass Valley - French Ditch Irrigation Company Site Reconnaissance

The inspection team members met at the location of the Grass Valley-French Ditch site with Mr. George Mastel at 3:00 p.m., on July 13, 1995. This installation varies from the other four diversions because it utilizes a natural channel to receive flow from the Clark Fork and does not require checking of the water level or gravel berms in the main river channel. A timber floor structure extends across the channel and provides increased water elevations (\approx 6.0 feet) during the low flow period. This structure was originally installed in the early 1900's and presently serves approximately 4,230 irrigated acres. The structure has been previously damaged during high flow periods and, at the time of inspection, there were two large logs resting on the crest.

The most recent damage occurred in the fall of 1994, when bed material was removed from beneath the timber floor and downstream of the structure in a localized area. Although the decking remained intact, significant flow was conveyed beneath the timber decking via the eroded area. Angular riprap ranging in size from 5-6 feet was placed in the damaged area near the left abutment. Additional material is scheduled to be placed after high water this year. Similar damage occurred in 1972 near the right abutment but was not visible at the time of inspection.

Timber flashboards are normally placed in late July from a trolley suspended above the structure to elevate the river water levels. This is accomplished with a 7 man crew, and requires about 8 hours.

G. Mastel mentioned that material was accumulating at a location approximately 100 feet downstream of the dam and that it had probably been removed from the toe of the structure. The team members felt that replacement of the material was appropriate.

2.6 Frenchtown Irrigation District Site Reconnaissance

At 1:30 p.m., on July 13, 1995, the inspection team members visited the headworks facilities of the Frenchtown ditch. Calvin Touchette, Mal Alexander and Tom Schetter represented the district. The diversion location was inaccessible, but has previously been inspected by M. Schwartz. The system serves 5,000 sprinkler irrigated acres through 17 miles of ditch at an estimated flow of 100-115 cts. The original channel was constructed in 1936, and the irrigation season is typically from May 1 to September 15. No problems have been encountered in the last five years with adequate flow in the system; however, gravel berms are utilized to divert additional flow when required.

Flow measurements in the channel are obtained with a concrete Parshall flume and staff gauge approximately 1.5 miles downstream of the headworks site. A manually operated radial gate is used to divert excess water from the headworks site back into the main channel. Noticeable leakage was evident, and is apparent, from a 4x6 timber that is missing where the gate contacts the floor of the surrounding concrete structure. The measured water depth upstream of the headgate site was > 9.5 feet, and 5 feet downstream. Any excavation or fill placed for installation of a diversion berm is performed with an ongoing 310 Permit, which indicates that a complete application is not required when work is performed.

Items investigated as a result of the inspection included recommendations for sluice-gate maintenance and assessment of the need for river channel improvements (berms) to improve diversion during low flows.

3 Missoula Irrigation District

3 Missoula Irrigation District

The Missoula Irrigation District's diversion system consists of a 230 ft. long rock irrigation diversion structure across the Clark Fork River, a 250 ft. long groin parallel to the Clark Fork River, a 2,400 ft. long approach channel along the left bank of the river, an intake structure with two vertical gates and a bypass structure to convey excess flows back to the river.

Aerial photography and photogrammetric mapping were obtained and used to assess this diversion system. The mapping is contained in Appendix B.

3.1 Diversion Alternatives

As noted in Section 2.2, the existing rock diversion structure is in good condition. There is some erosion on the bank of the approach channel near the intake structure and the rubble overflow weir or "blow-out" near the bypass structure exhibits significant leakage.

Bank erosion near the intake structure should be repaired with riprap or gabion erosion protection.

Three alternatives to repair the overflow "blow-out" near bypass structure were investigated:

1. Reconstruct the overflow to the same elevation (3,180 ft.) using riprap and rockfill. The upstream slope could be as steep as 1.5 H to 1 V and the downstream slope should be no steeper than 6 H to 1 V. A crest width of about 4 ft. would be adequate for access and maintenance.
2. Replace the existing overflow with a concrete overflow structure to elevation 3,180 ft. This structure would be a typical concrete overflow that is keyed into the foundation and protected from erosion downstream with riprap.
3. Replace the existing overflow with a higher earthfill embankment. This embankment would be set just below the top of the concrete intake and bypass structures (elev. 3,187 ft.). This embankment would normally not be overtopped but could still be breached if a flood of greater than about 27,000 cfs. occurs. A flood of this magnitude is likely to occur at a frequency of about 1 in 10 years.

3.2 Recreation, Aesthetic and Habitat Factors

Due to the heavy recreational use, there are a number of improvements which should be considered at this site. While some are aesthetic, many are critical to the safety of the public using this area. At a minimum, it is recommended that grates be placed over the two large openings in the by-pass structure. Also, an attractive hand rail system should be installed along the leading edge of the structure, especially over and around the stop boards.

Any reconstruction or replacement of the existing rubble overflow should include provisions for public access and use. Complete redesign of this area for public use could engender some strong interest if, for example, a well-publicized professional design competition was held. In addition to accommodating public use, such a design might include sculptural and water features.

It is recommended that as part of any improvements to the sites, the District take the lead in coordinating a simple interpretive sign program with the appropriate irrigation entities which tells about the history and operation of each. At those sites where public access is or will be in place, a few attractive, simple and durable signs could be placed providing, with maps, sketches, photos, etc., some interesting historical and operational information. The basic story that they were and are still needed to convey water to agricultural and other users of the Valley needs to be told. If, for example, the produce sellers at the Farmer's Market use this water, this needs to be stated. There are a variety of relatively inexpensive sign types available for this purpose. The interpretive sign at John Toole Park (behind the Missoulian) is one nearby example.

This site is particularly suited for the placement of at least one of the interpretive signs. Such a sign could be part of an ensemble of benches and a trash container located, for example, near the junction of the two main trails on the south side of the approach channel.

3.3 Legal Factors

The legal factors for the proposed combination of the Missoula and Orchard Homes diversion systems are discussed in Section 4.3.

Ramifications for other proposed modifications or continued operation of the facilities is as follows:

- a. As with most of the diversions in high use areas, the safety is of concern. The proposed engineering and recreational alternatives for this diversion should help mitigate these concerns.
- b. The proposed engineering and recreational alternative improvements for this diversion would not impact the water rights of the Missoula Irrigation District.
- c. The liability that an organization or company may be exposed to regarding safety or other considerations depends on the organization or company's exact legal designation as a particular type of entity. Montana law provides certain protections to an irrigation district which reduces its exposure to liability. In fact, the irrigation district may only be liable for personal injury for willful and wanton misconduct or gross neglect. §85-7-2212 MCA. If additional problems continue, it is possible this district could actually have an increase in liability exposure.
- d. Without changes in the current structures, the company would have to continue to contend with yearly upkeep and problematic maintenance issues that could require a permit from MCCD.

NOTE: A "project" that is engaged in without prior approval is considered to be a public nuisance unless it is an emergency. §75-7-123 MCA

3.4 Estimated Costs

The estimated cost of design and construction of the alternative improvements are as follows:

A.	Riprap or gabion erosion protection near intake	\$2,500
B.	Overflow "blowout" near bypass structure	
	• riprap and rockfill	\$45,000
	• concrete overflow	\$80,000
	• higher earthfill embankment	\$50,000

The higher earthfill embankment is the recommended alternative based on aesthetics, recreational opportunities, safety and costs

C.	Public safety grates over bypass openings	\$2,000
D	Public safety handrails	\$1,500
E	Overflow "blowout" - public access improvements - design competition (for construction add 15% to selected alternative)	\$5,000
F	Interpretive signage	\$1,500

3.5 Action Plan of Improvements

The recommended plan of action for the Missoula Irrigation District includes contact with Orchard Homes Irrigation Company related to a possible combined system as described in Section 4. Public safety concerns should be addressed immediately. Preliminary plans for operational, recreational and aesthetic improvements should be developed for presentation to various public agencies. This would help identify funding sources and inform the public of the proposed improvements.

The following priorities for the proposed improvements are based on the degree of need for the improvement; safety, legal and recreational issues and the estimated cost. Safety issues were given priority over operational and other concerns. The least costly option has been selected where more than one option exists for an alternative improvement.

The items are listed below from highest to lowest priority:

- Public safety grates over bypass openings
- Public safety handrails
- Riprap or gabion erosion protection near intake
- Interpretive signage
- Overflow "blowout" near bypass structure - higher earthfill embankment
- Overflow "blowout" - public access improvements - design competition

4 Orchard Homes Irrigation Company

4 Orchard Homes Irrigation Company

The Orchard Homes Irrigation Company's diversion system consists of a damaged timber floor irrigation diversion structure across part of the Clark Fork River, an existing rock groin and 750 ft. long approach channel along the left bank of the river, an intake structure with one vertical gate and a bypass structure to convey excess flows back to the river.

Aerial photography and photogrammetric mapping were obtained and used to assess this site as part of the study. The mapping is contained in Appendix B.

4.1 Diversion Alternatives

Individual System

The original timber floor diversion structure was destroyed by ice in 1955. Since that time, the approach channel has effectively been extended upstream towards Higgins Ave. bridge with gravel or sand bag groins. There are several approach channel "blowouts" which impair the diversion capacity and the bypass structure crest appears low.

Preliminary assessment of this irrigation diversion system indicates that diversion at low flow could be improved by extending the guides on the bypass structure, blocking off the "blowouts" and building a higher groin. These proposed improvements should be assessed further to ensure the improvements would be adequate. The guides would need to be increased to check up the water levels by about an additional 1 ft. The "blowouts" would be blocked with a dike built to elevation 3,176 ft. and the groin would be built to the same elevation. The groin and dike would be subject to overtopping by a flood of greater than 27,000 cfs. A flood of this magnitude is likely to occur at a frequency of about 1 in 10 years. The damaged sections of the groin or dike would then require repair.

If a further assessment of the above alternative indicates improvements are not adequate, then construction of a diversion structure across the river would be required, along with the groins and dikes discussed above. These alternative diversion structures would be located about 200 ft. upstream of the original timber diversion structure. Four alternative diversion structures are discussed below:

- Construction of a new timber floor diversion structure similar to that used on the Grass Valley - French Ditch irrigation system is not recommended. A structure

of this nature that could be placed close enough to the river bed to prevent damage from ice could not use a manually installed system of stoplogs for checking up the water levels to the required height (about 6 ft)

- Construct a rockfill diversion structure similar to the Missoula Irrigation District's diversion structure. This structure would have a maximum elevation of about 3,171 ft. to minimize its backwater effect during larger floods. The rock material to be used should be between 2 ft. and 5 ft. in diameter and should be placed during low flow conditions so that a well armoured interlocked mass can be created. The downstream side of the rock diversion should be placed on a slope not exceeding 8 H to 1 V, creating about a 50 ft. wide structure. A slightly lower notch may be provided in the crest for recreational water users if considered desirable.
- Construct a concrete diversion structure with timber checks. The concrete portion of this structure would be installed about 2 ft. above the average bed level in the river and would be keyed into the foundation and protected upstream and downstream with riprap. The timber checks would be capable of raising the water levels by 3 ft. Timber checks would need to be installed and removed annually with the help of a piece of heavy construction equipment working its way across the river on the downstream side of the timber checks.
- Construct a concrete diversion structure with an Obermeyer overflow gate as shown in Figure 4.1. The concrete portion of this structure would be installed about 2 ft. above the average bed level in the river and would be keyed into the foundation and protected upstream and downstream with riprap. The Obermeyer overflow gate would be capable of checking the water levels by 3 ft. and would be operated annually by inflating and deflating the rubber bladder from a control building on shore.

Combined System

The recommended alternative to improve the irrigation diversion is to consider combining the two irrigation facilities by supplying the Orchard Homes Irrigation Company canal from the Missoula Irrigation District's canal. The Missoula canal is located within 50 ft. of the Orchard Homes canal near the intake structure. At this location, the water level in the Missoula canal is about 6 ft. above the Orchard Homes canal water level. At the time of inspection, peak diversion canal flows were believed to be observed. Under these conditions, the existing Missoula canal has some additional flow capacity. Preliminary

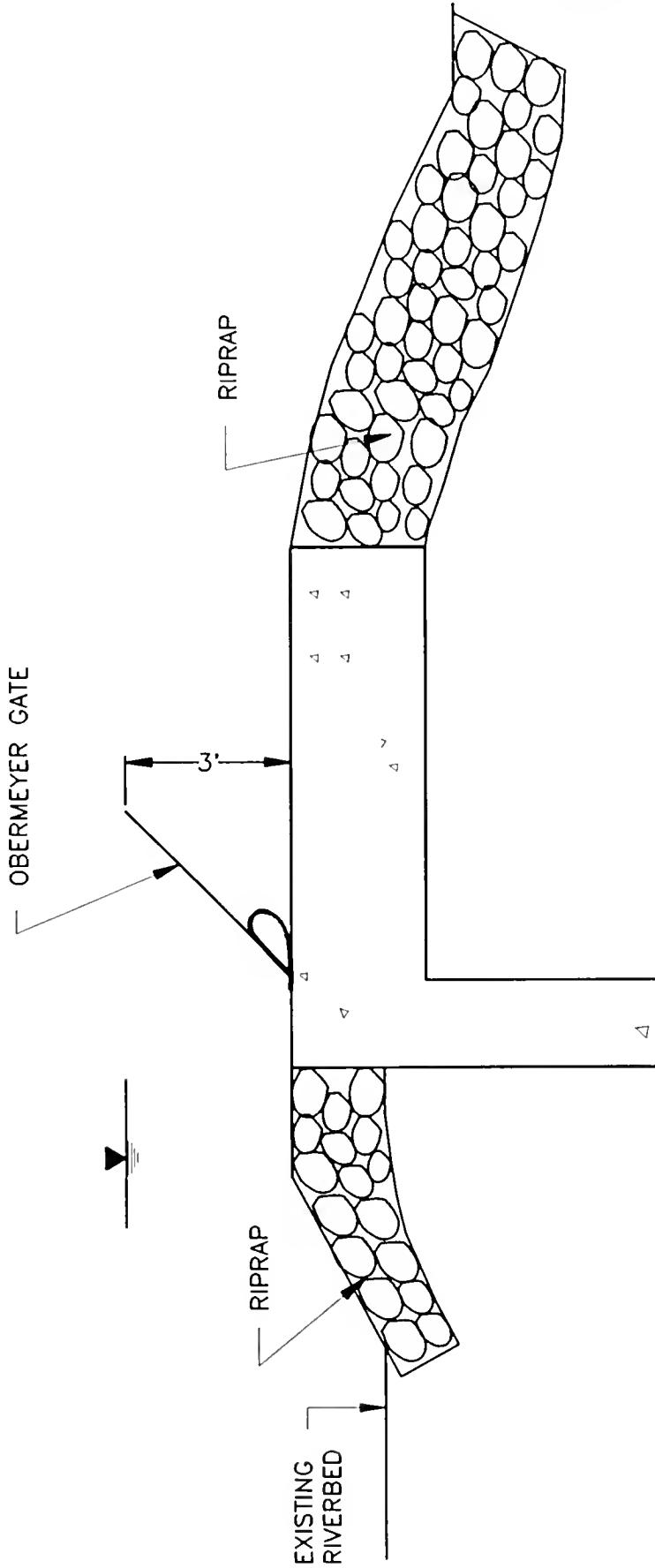


FIGURE 4.1

**CLARKFORK RIVER IRRIGATION DIVERSIONS
CONCRETE DIVERSION WITH
OBERMEYER GATE**



estimates of the flow observed in the Orchard Homes canal suggest it is somewhere between 10% and 30% of the flow observed in the Missoula canal

It is estimated that the Orchard Homes canal could be supplied with about a 1 to 2 ft. increase in Missoula canal level. This would require confirmation with some additional surveys and engineering assessment. It is estimated that some additional diking along the Missoula canal and a gated turnout structure from the Missoula canal to the Orchard Homes canal would be required. This gated turnout structure will be located just downstream of the existing Orchard Homes intake structure and may consist of an underground box culvert with energy dissipation facilities at the downstream end. Depending on a detailed assessment of this alternative, some existing facilities may require improvement. Particular attention should be given to the Missoula canal intake and the Missoula river diversion structure.

4.2 Recreation, Aesthetic and Habitat Factors

This diversion provides no particular recreational attraction to this area since the main uses here are pedestrians and bicycles using the existing Riverfront Trail and people on the lawn in front of the Boone and Crockett Club building. These uses would likely continue regardless of any changes to the diversion. Since the water level of the approach channel is down a steep bank several feet from the trail and bank top, there is really no water access in this area. Also, the presence of a fairly thick screen of vegetation along this bank obscures a substantial portion of the river and diversion canal, particularly west of the main B/C Building.

The overflow near the headgate creates an attractive stream running back into the main river. As with other similar streams, it provides for pleasant and easy water access for children who want a relatively safe place for water play. It also provides habitat protection as noted below.

This diversion raises several aesthetic and liability concerns. The most obvious is the presence of the remainder of the original diversion structure directly opposite Caras Park on the north bank. Nearly every person contacted in this investigation commented about the appearance and hazard of this structure. There are protruding sections of concrete rubble and steel bars which could cause serious injury to unsuspecting boaters, since they are not readily visible at high water. Since the value of this structure to the diversion is questionable, a program of either complete removal (over a reasonable time period) or removal of the most dangerous portions should be seriously explored so as to reduce liability exposure to the company and District.

Downstream of the Boone and Crockett Club there are several places where steel shapes and concrete rubble have been placed along the outboard dike of the approach canal or in openings or "blowouts". Even though a heavy band of vegetation largely obscures the worst of these cases, an approximately 50-foot long opening directly opposite the "Clark Fork Natural Park" sign provides a clear view of some of these materials which should be cleaned up. Downstream, the concrete and steel overflow bypass structure is quite unattractive and should also be improved. Since there is a desire to maintain a flow in the overflow channel for habitat purposes, perhaps removal of only part of the overflow should be explored.

As alluded to earlier, the stream from the overflow weir provides some protection to wildlife that inhabit the adjacent island as well as providing additional riparian habitat along its banks. The wildlife value of this and the other nearby islands was highlighted by the official dedication of the "Garden City Islands" by Mayor Dan Kemmis on 26 October, 1995. All of the islands are part of a five-year lease secured by the Five Valleys Land Trust and the City of Missoula from the State of Montana for the purposes of managing the islands in their natural state as a wildlife education area. Therefore, retention of the overflow stream in some form should be strongly considered as part of any future plans.

An interpretive sign discussing the relationship of the irrigation diversion and the islands should be considered for this area. This installation should be coordinated with the City, MRA and the Five Valleys Land Trust.

4.3 Legal Factors

Individual System

The legal factors for the proposed diversion alternative of combining the points of diversion are discussed below.

Ramifications for other proposed alternatives:

- a. As with most of the diversions, the safety is of concern. The proposed engineering and recreational alternatives should help mitigate these concerns.
- b. The proposed engineering and recreational alternative improvements for this diversion would not impact the water rights of the Orchard Homes Irrigation Company

- c. The liability that an organization or company may be exposed to regarding safety or other considerations depends on the organization or company's exact legal designation as a particular type of entity. OHDC was incorporated under the laws of the State on June 4, 1906. The company's Articles of Incorporation and subsequent amendments do not clearly indicate the exact legal entity of the company. More research would be required to determine whether or not it could be considered to be some form of water users' association or another form of corporate entity. The legal ramifications are that a water users' association is solely liable for any court action which may be brought against it for any injuries or damages occurring on the works that cause failure to maintain safe working and operating conditions. see §85-6-107 MCA. An irrigation district does not have this sort of exposure. If additional problems continue, it is possible the company might have liability exposure.

- d. Without these proposed alternative(s), the company would have to contend with yearly upkeep and problematic maintenance issues that could require a permit from MCCD which would have its own legal requirements.

NOTE: A "project" that is engaged in without prior approval is considered to be a public nuisance unless it is an emergency. §75-7-123 MCA.

Combined System

Orchard Homes Ditch Company (OHDC) was incorporated under the laws of the State on June 4, 1906 for the purpose of selling, leasing and disposing of waters to the inhabitants of Orchard Homes or others. Records indicate that it extended the company's existence in 1946 and 1986. It continues in existence under the laws of the state as a registered corporation.

Missoula Irrigation District (MID) was formed on October 14, 1922 by order of the district court for maintenance and operation of the irrigation project by the owners of the land served by the Miller-Kelley-Cave-Gannon Ditch in existence at that time. The order indicated that the water rights of the owners as of 1905 would not be disturbed by consolidating them into the irrigation district. (Generally, an irrigation district owns the water rights unless otherwise specified.)

Today, MID continues to operate as an irrigation district under the laws of the State of Montana. The last 310 permit was obtained from the MCCD in 1985 for ditch repairs.

NOTE: MCCD charged MID with a violation of the 310 permit process in 1993 due to dozer activity in the river at the MID point of diversion. MID was acquitted of the violation at trial on the issue. Activities in the river are still a concern to MCCD.

WATER RIGHTS OF PARTIES NOT AFFECTED EXCEPT AT POINT OF DIVERSION

Montana law requires that any change in a place of diversion of water is technically a change in the water right of the party. Therefore, to combine these two diversion points, a permit would be required from the Department of Natural Resources and Conservation (see DNRC permit discussion below). However, all other aspects of the parties respective water rights and any underlying individual water rights would remain unchanged. For example, the amount of flow, the location of use, the purpose of use, etc. would remain intact as they exist now. The sole change would be the location of the point of diversion. Although these underlying rights would not change, it may be prudent to recommend that the parties consider an agreement of understanding about the location at which one ditch would diverge from the other, how the shared portion of the ditch would be monitored and maintained, and any other pertinent concerns.

PERMITS REQUIRED FOR COMBINING DIVERSION POINTS

Federal laws and Montana laws require various permits to be approved before the Orchard Homes Ditch Company and the Missoula Irrigation District would be allowed to combine their points of diversion.

DNRC Permit

The parties would need to apply to the Department of Natural Resources and Conservation (DNRC) for a change in appropriation rights as they relate to the point of diversion. A permit must be approved if the appropriator meets the following criteria:

- a) The proposed use will not adversely affect the water rights of other persons or planned uses or developments that have permits;
- b) The proposed means of diversion, construction and operation of the appropriation works are adequate;
- c) The applicant has a proprietary interest in the property where the water is to be put to beneficial use;

- d) The water quality of an appropriator will not be adversely affected
- e) The ability of a discharge permitholder to satisfy effluent limitations, as prescribed by law, will not be adversely affected. §85-2-402 MCA

A change in a point of diversion is a change in an appropriation right or a water right. As such, the above criteria will need to be met for this project to be approved for a permit under this Act. Other water rights of the parties would not be affected by this activity.

MISSOULA COUNTY CONSERVATION DISTRICT Permit

The second permit required for a project in the river is from the Missoula County Conservation District. MCCD regulates the uses of waters as they affect erosion and water quality pursuant to The Natural Streambed and Land Preservation Act of 1975. §75-7-102 MCA

No vested or existing water rights may be impaired by the enforcement of the Act and the policy of the State is to recognize the needs of irrigation and agricultural use of the rivers and streams as well as streambed and land preservation.

If the activity being proposed fits the definition of a "project", then a 310 permit is required. Under the Act, a "project" is defined as any physical alteration or modification of a stream which results in a change in the state of the stream in violation of state policy. §75-7-103 MCA.

An activity is not considered a "project" if it is a customary and historic maintenance and repair of existing irrigation facilities that either does not significantly alter or modify a stream or for which an annual plan is submitted to, and approved by, the district. §75-7-103 MCA

NOTE A project that is engaged in without prior approval is considered to be a public nuisance unless it is an emergency. Such a project is subject to prosecution by the County Attorney.

ARMY CORPS OF ENGINEERS Section 404 permit

The third permit that may be required for the combination proposal is a permit from the federal agency, the Army Corps of Engineers (Corps). The Corps has jurisdiction over navigable waterways and jurisdiction to enforce the Clean Water Act which covers all

waterways. Generally, any construction, changes, redesigns, enlargements or placements of materials in the river are subject to the Section 404 permit process.

DEPT. OF STATE LANDS Application

Additionally, the Department of State Lands for the State of Montana requires that an application be submitted to them to determine whether a permit is needed if there will be "any occupation" of the riverbed between low water mark to low water mark. The Department will review the proposed plans and indicate whether a permanent easement or a temporary permit are necessary for the project.

DEPT. of TRANSPORTATION concerns

If alterations were to be needed for culverts going under the two main bridges at Madison and Higgins, the Dept. of Transportation would need to be involved in the issue. Under this proposal, no alteration of the culverts is necessary at this time.

NOTE: A right-of-way across any stream of water, street, canal, ditch, etc., is automatically granted to any irrigation district and the state does not have the ability to require payment for such crossings. See §85-7-1909 MCA.

SUMMARY ON COMBINATION OF DIVERSIONS

In summary, if the criterion for each required permit is met, combining diversions would be legally feasible were the parties to request it. Since permit approval would hinge on the particulars of the project, attention would have to be paid to the details of the final proposal, particularly regarding the activities and structures that would be necessary to accomplish the combined diversion.

Although the underlying water rights of the parties would not be affected except the point of diversion, it would be prudent to recommend that the parties clarify, in an agreement, the location at which the ditches would diverge, clarify how the point of diversion and the shared portion of the ditch would be monitored and maintained, and any other pertinent issues.

4.4 Estimated Costs

Individual System

The estimated cost of design and construction of the alternative improvements for the individual system are as follows:

A	Increase height on bypass by adding to guides	\$3,000
B	Construct groin and block "blowouts"	\$90,000
C	Construct diversion structure and groin	
	• timber floor	not recommended
	• rockfill structure	\$270,000
	• concrete structure/timber checks	\$810,000
	• concrete structure/obermeyer overflow	\$960,000

The rockfill structure is the recommended alternative based on costs

D	Removal/modification of existing damaged in-river diversion structure	\$30,000
E	Clean-up along approach channel	\$12,000
F	Clean-up, modify bypass overflow weir	\$3,000
G	Interpretive signage	\$1,500

Combined System

The estimated cost of design and construction of the alternative improvements for the combined system are as follows:

A	Construct diking along canal	\$30,000
B	Construct turnout structure	\$40,000
C	Expand intake if required	\$50,000

D.	Raise diversion structure if required	\$135,000
E.	Removal/modification of existing damaged in-river diversion structure	\$30,000
F.	Clean-up along approach channel	\$12,000
G.	Clean-up, modify bypass overflow weir	\$3,000
H.	Interpretive signage	\$1,500

4.5 Action Plan of Improvements

The recommended plan of action for the Orchard Homes Irrigation Company includes contact with Missoula Irrigation District related to a possible combined system as described above. Preliminary plans for operational, recreational and aesthetic improvements should be developed for presentation to various public agencies. This would help identify funding sources and inform the public of the proposed improvements. It is recommended that the additional work required to confirm the engineering feasibility and legal requirements for a combined diversion system be conducted as part of this process. All efforts should be made to consider combining diversions instead of improving the individual systems as it is likely superior for aesthetics, recreational activities, safety and cost.

A decision related to the possibility of a combined system will effect the plan of action for this irrigation company. The following priorities for the proposed improvements are based on the degree of need for the improvement; safety, legal and recreational issues and the estimated cost. Safety issues were given priority over operational and other concerns. The least costly option has been selected where more than one option exists for an alternative improvement.

The items are listed below from highest to lowest priority:

Combined System

- Interpretive signage
- Construct diking along canal
- Construct turnout structure

- Expand intake if required
- Raise diversion structure if required
- Clean-up, modify bypass overflow weir
- Clean-up along approach channel
- Removal/modification of existing damaged in-river diversion structure

Individual System

- Interpretive signage
- Increase height on bypass by adding to guides
- Clean-up, modify bypass overflow weir
- Construct groin and block "blowouts"
- Clean-up along approach channel
- Removal/modification of existing damaged in-river diversion structure
- Construct diversion structure and groin if required

5 Hellgate Irrigation Company

5 Hellgate Irrigation Company

The Hellgate Irrigation Company's diversion system consists of a 250 ft long rock irrigation diversion structure across part of the Clark Fork River, a 230 ft long groin, a 1,500 ft long approach channel along the right bank of the river, an intake structure with vertical gates and a bypass structure to convey excess flows back to the river.

Aerial photography and photogrammetric mapping were obtained and used to assess this site as part of the study. The mapping is contained in Appendix B.

5.1 Diversion Alternatives

As noted in the site reconnaissance, the existing concrete intake and bypass structures are in good condition. There is a minor "blowout" along the approach channel and the diversion structure and rock groin have been repaired frequently to improve irrigation diversion during low river discharges.

Through discussions with MCCD staff, it appears that the bypass structure at this site is always releasing water. A recommended operational improvement is to operate only the bypass during high sediment periods.

An earthfill dike with a crest elevation of about elevation 3,167 ft. should be constructed across the "blowout". The groin running parallel to the flow should be built to the same elevation. The groin, dike and much of the surrounding ground on the island would be subject to overtopping by a flood of greater than 21,000 cfs. A flood of this magnitude is likely to occur at a frequency of about 1 in 5 years. The damaged sections of the groin or dike would then require repair. To prevent frequent overtopping a dike along most of the length of the approach channel would be required. The district should assess the overall merits of increasing the height of the dike.

The existing rock diversion structure across the river should be repaired or replaced along with the groins and dikes discussed above. The replacement diversion structures would be located just upstream of the existing rock diversion structure. Repair of existing rock diversion and three alternative diversion structures are discussed below:

- Repair and add to the existing rock diversion structure. This structure should have a maximum elevation of about 3,163 ft. to minimize its backwater effect during larger floods. The rock material to be used should be between 2 ft and 5 ft. in diameter and should be placed during low flow conditions so that a well

armoured interlocked mass can be created. The new material should be added to the upstream side of the existing rock. The downstream side of the new rock diversion should be placed on a slope not exceeding 8 H to 1 V, adding about 15 ft. of width to the existing structure. A slightly lower notch may be provided in the crest for recreational water users, if it is desirable.

- Construction of a new timber floor diversion structure similar to that used on the Grass Valley - French Ditch irrigation system is not recommended. A structure of this nature that could be placed close enough to the river bed to prevent damage from ice could use a manually installed system of stoplogs for checking up the water levels by at least 6 ft.
- Construct a concrete diversion structure with timber checks. The concrete portion of this structure would be installed about 4 ft. above the average bed level in the river and would be keyed into the foundation and protected upstream and downstream with riprap. The timber checks would be capable of checking the water levels by 3 ft. Timber checks would need to be installed and removed annually with the help of a piece of heavy construction equipment working its way across the river on the downstream side of the timber checks.
- Construct a concrete diversion structure with an Obermeyer overflow gate, as shown on Figure 4.1. The concrete portion of this structure would be installed about 4 ft. above the average bed level in the river and would be keyed into the foundation and protected upstream and downstream with riprap. The Obermeyer overflow gate would be capable of checking the water levels by 3 ft. and would be operated annually by inflating and deflating the rubber bladder from a control building on shore.

5.2 Recreation, Aesthetic and Habitat Factors

While the river diversion here is the most obtrusive and least attractive of all sites, this site has the greatest potential for recreational use, even though it receives little such use now. Also, this stretch of the Clark Fork River has the greatest (both existing and potential) visibility of any portion within the City, by virtue of its proximity and exposure to some 500 feet of West Broadway, a major east-west arterial street. Therefore, any improvements here must be sensitive to both the future recreational use and the river's visibility.

Missoula Redevelopment Agency (MRA) is planning a variety of improvements for this area. Some are already underway, others are planned or under consideration:

- A paved 10-12' wide pedestrian/bicycle trail, passing in front of Eagle Watch Estates, connecting the end of Ashland Street to the end of California Street should be under construction by spring 1996. In addition, the plans call for benches, trash containers and landscaping (lighting will occur later)
- MRA is open to the concept of improved access to the in-board side of the irrigation headgate (directly in front of Eagle Watch Estates), but has not proceeded due to cost limitations.
- Construction plans are being prepared for a new California Street bicycle/pedestrian bridge to replace the one which was removed over ten years ago.
- MRA has completed a comprehensive land use analysis of the island immediately adjacent to the approach channel. The purpose of the study was to explore the recreational development potential of the island for inclusion within MRA's Urban Renewal District II as part of the park/trail system that will soon parallel the river. The report notes a fairly significant potential for some type of recreational development. Action by MRA will largely depend on the outcome of more detailed research to determine finally the island's current ownership. Assuming this can be resolved, it is likely that some type of recreational development will occur in time. Because any recreational improvements will, at a minimum, require access over the approach channel, coordination between the District and company, and MRA and Missoula Parks Dept. will be critical to their success.
- The City Public Works Department is currently preparing plans to construct walkway improvements from Front Street to Russell Street. It is expected, therefore, that a complete bike/pedestrian pathway system in this area will be complete within a couple of years.
- MRA is awaiting funding from the state (CTEP funds) and completion of relocation plans before acquiring and demolishing the second-hand stores and barber shop between W. Broadway and the river, at the foot of Nora Street. This action will likely occur within the next eight months.

Any operational modifications to this diversion will need to be done in light of the potential recreational improvements in this area. For example, the small stream resulting from a "blowout" in the approach channel may be diverting precious water from the channel, however, it provides easy, direct and relatively safe water access for children who may be using this area in the future

There is considerable interest by the residents of Eagle Watch Estates a seniors residential facility, to have some type of access onto the massive headgate and diversion structure directly in front of their building. Such access is also appropriate in view of the soon to-be completed bike/pedestrian trail which will pass directly adjacent. An ADA-accessible ramp could be provided to a deck (nestled in the inboard side of the structure) with a curb, handrails and benches so that the senior citizens and others could enjoy a view of this facility. Such an installation would also reduce the company's liability exposure from accidents that might result without some type of safety handrail. This would be a prime spot to have a descriptive sign of the use and history of this type of irrigation in the Missoula Valley.

The new Downtown Lions Park lies along the irrigation canal between Eagle Watch Estates and the foot of California Street. Because of its close proximity to the canal, a low wire mesh fence may be needed along the park's lower edge to keep stray balls, etc. from rolling into the canal.

The general aesthetic aspects of this diversion have already been touched upon. While the diversion structure in the river is quite obvious and obtrusive, it is not blatantly ugly. That it completely spans the river makes it particularly obvious. It is most obtrusive at the north (near) end where large boulders protrude to form the corner of the structure. Since the river descends fairly rapidly here, the structure's presence creates white water for some distance downstream. While its presence creates some hazard to boaters and rafters, it is not so critical here as with the Caras Park structure since its existence is fairly obvious. As noted above, any changes or improvements here will have to be extremely sensitive to the area's high visibility.

While there are some piles of driftlogs and other wood along the edge of the canal below the diversion, they are not offensive and are not enough of an aesthetic problem to create the need for a special clean-up. Even so, when any other work is done in the area, crews could also clean up areas.

According to the MRA study there are "no Threatened or Endangered species that would be harmed or encroached upon by the potential minor development that could take place at the site." Bald eagles are, however, present in the area, nesting and feeding in the river corridor. Because of its location within the flood zone, a federal environmental assessment would be required prior to construction of any capital improvements.

5.3 Legal Factors

Ramifications for proposed alternative

- a. As with the other diversions, the safety is also of concern with the Hellgate Valley Irrigation Company. The proposed engineering and recreational alternative for this diversion should help mitigate these concerns and should lessen the liability exposure of the company
- b. The proposed engineering and recreational alternative improvements for this diversion would not impact the water rights of the Hellgate Irrigation Company.
- c. Without changes, the company will continue to contend with its frequent repairs and attempted spillway stabilization that usually require permits from MCCD.
- d. Any improvements in the structures which also accommodate the increased recreational use of the river will improve safety and reduce potential liability. Proposed signage for any unfamiliar or unusual diversion structures in the river would assist in decreasing safety concerns and any potential liability.

5.4 Estimated Costs

The estimated cost of design and construction of alternative improvements are as follows:

A.	Construct earthfill dike across "blow out"	\$1,500
B.	Repair or replace diversion structure and groin	
	• timber floor	not recommended
	• add to existing rock structure	\$135,000
	• concrete structure/timber checks	\$750,000
	• concrete structure/Obermeyer overflow	\$900,000

Adding to the rockfill structure is the recommended alternative based on costs.

C.	Public deck with ADA access ramp, benches, trash bin and handrails.	\$6,000
D	Safety handrails on existing structures	\$1,500
E	Interpretive signage	\$1,500
F.	Low wire mesh fence for Downtown Lions Park	\$3,000

5.5 Action Plan of Improvements

The recommended plan of action for the Hellgate Irrigation Company is outlined below. Public safety concerns should be addressed immediately. Preliminary plans for operational, recreational and aesthetic improvements should be developed for presentation to various public agencies. This would help identify funding sources and inform the public of the proposed improvements.

The following priorities for the proposed improvements are based on the degree of need for the improvement; safety, legal and recreational issues and the estimated cost. Safety issues were given priority over operational and other concerns. The least costly option has been selected where more than one option exists for an alternative improvement.

The items are listed below from highest to lowest priority:

- Safety handrails on existing structures
- Public deck with ADA access ramp, benches, trash bin and handrails
- Interpretive signage
- Construct earthfill dike across "blow out"
- Repair or replace diversion structure and groin by adding to existing rock structure
- Low wire mesh fence for Downtown Lions Park

6 Grass Valley - French Ditch Irrigation Company

6 Grass Valley - French Ditch Irrigation Company

The Grass Valley French Ditch Irrigation Company's diversion system consists of a timber floor irrigation diversion structure with 6 ft. high timber stoplogs located on a side channel of the Clark Fork River, a short approach channel along the right bank of the river and an intake structure with two vertical gates.

Aerial photography was obtained and used to assess this site as part of the study

6.1 Diversion Alternatives

This diversion site operates satisfactorily with some difficulty during low river flows. It has experienced some erosion downstream of the structure but this has generally been repaired. The installation of the timber stoplogs is difficult and is accomplished from a trolley suspended from a cable.

Being located on a side channel of the Clark Fork River makes this site unique. In future, if the water supply to the side channel decreases then a river groin at the entrance to the side channel should be considered. When, or if, this improvement will be required is dependent on river regime conditions. Another improvement which may be cost effective but is beyond the scope of this study is sediment removal and weed control in the delivery canal.

Short term plans for the diversion facilities should include maintenance of the erosion protection of the river bed downstream and upstream of the timber floor. Diligent maintenance with large rock (minimum 3 ft. diameter) will prevent any future undercutting and damage to the timber floor. To improve the timber check installation procedure, the cable supporting the trolley should be tightened and a lightweight, non-slip grating should be installed as the trolley floor.

Medium term plans should consider installing new check supports and replacing some timber decking on the existing timber floor diversion, as required.

Long term plans at this site should recognize that the existing diversion will require replacement. Three structure alternatives are discussed below:

- Construction of a new timber floor diversion structure similar to the existing structure. A structure of this nature should again be placed close enough to the

river bed to prevent damage from ice. The supports for the timber stoplogs could be improved to simplify the installation

- Construct a concrete base with an inflatable rubber overflow. The concrete portion of this structure would be installed just above the average bed level in the river and would be keyed into the foundation and protected upstream and downstream with riprap. The inflatable rubber overflow would be capable of checking the water levels by about 6 ft and would be operated annually by inflating and deflating the rubber overflow from a compressor/blower on shore.
- Construct a concrete diversion structure with an Obermeyer overflow gate similar to that shown on Figure 4.1. The concrete portion of this structure would be installed just above the average bed level in the river and would be keyed into the foundation and protected upstream and downstream with riprap. The Obermeyer overflow gate would be capable of checking the water levels by about 6 ft. and would be operated annually by inflating and deflating the rubber bladder from a compressor/blower on shore.

6.2 Legal Factors

The key concern with this diversion has been the frequency of the activity in the river and the impact of the activity on water quality when the district attempts to maintain the structures at the point of diversion. The continued legal concern is with carrying out the Annual Plan of Operation submitted and approved by the MCCD in 1990. This proposed alternative would help to reduce the district's potential liability exposure, as well as helping to reduce the impact on water quality. The proposed engineering alternative improvements for this diversion would not impact the water rights of the Grass Valley - French Ditch Irrigation Company.

6.3 Estimated Costs

The estimated cost of design and construction of the alternative improvements is as follows:

A.	Erosion protection downstream and upstream of existing diversion	\$10,000
B.	Tighten trolley cable and install floor grating	\$5,000

C.	Install new check supports and timber decking on existing diversion	\$10,000
D	Reconstruct diversion structure	
	• timber floor	\$75,000
	• concrete/rubber overflow	\$630,000
	• concrete/Obermeyer overflow	\$470,000

The timber floor is the recommended alternative based on costs and past performance.

6.4 Action Plan of Improvements

The recommended plan of action for the Grass Valley - French Ditch Irrigation Company is outlined below. Safety concerns should be addressed immediately. Preliminary plans for operational improvements should be developed for presentation to various public agencies. This would help identify funding sources.

The following priorities for the proposed improvements are based on the degree of need for the improvement, safety issues and the estimated cost. Safety issues were given priority over operational and other concerns. The least costly option has been selected where more than one option exists for an alternative improvement.

The items are listed below from highest to lowest priority:

- Tighten trolley cable and install floor grating
- Erosion protection downstream and upstream of existing diversion
- Install new check supports and timber decking on existing diversion
- Reconstruct timber floor diversion structure

7 Frenchtown Irrigation District

7 Frenchtown Irrigation District

The Frenchtown Irrigation District's diversion system consists of a long approach channel along the right bank of the Clark Fork River, an occasionally installed gravel groin across the Clark Fork River, an intake structure with two vertical gates and a bypass structure equipped with a radial gate.

Aerial photography was obtained and used to assess this site as part of the study.

7.1 Diversion Alternatives

The existing diversion system generally operates satisfactorily with only occasional diversion problems during low river flow. There is a minor "blowout" along the approach channel and some leakage under the radial gate at the bypass structure.

During low river flows, improved diversion is accomplished by creating a small mound of cobbles across the river when required. This concept would be more flood resistant if larger, 1 to 2 ft. diameter rock was used instead of river cobbles.

The "blowout" along the approach channel should be repaired with a small dike that is high enough not to be frequently overtopped during floods. It is estimated that this dike be about 5 to 7 ft high and overtopping may occur an average of once every 10 years.

The leakage at the bypass structure is not significant at this time and the replacement of the missing 4 x 6 sealing timber can be deferred. The gate leakage and need for maintenance should be reviewed as required.

7.2 Legal Factors

The concern with this diversion has been the frequency of the activity and the impact of that activity on water quality when the company attempts to maintain the structures at the point of diversion. Another factor is recognizing the concerns expressed by an adjacent landowner regarding bank erosion. The continued legal concern is with frequent requests for 310 permits from MCCD. The proposed alternative of a rock groin or diversion structure of larger rock would significantly reduce the expense to the district and the company's potential liability exposure, reduce the need for frequent permit requests to MCCD and reduce the impact on water quality. The proposed engineering alternative improvements for this diversion would not impact the water rights of the Frenchtown Irrigation District.

7.3 Estimated Costs

A	Diversion structure of large rock instead of cobble	\$25,000
B	"blowout" channel dike	\$1,500

7.4 Action Plan of Improvements

The recommended plan of action for the Frenchtown Irrigation District is outlined below. Preliminary plans for operational improvements should be developed for presentation to various public agencies to help identify funding sources.

The following priorities for the proposed improvements are based on the degree of need for the improvement and the estimated cost. The least costly option has been selected where more than one option exists for an alternative improvement.

The items are listed below from highest to lowest priority:

- "blowout" channel dike
- Diversion structure of large rock instead of cobble

8 General Recommendations

8 General Recommendations

It is recommended that the additional work required to confirm the engineering feasibility and legal requirements for a combined diversion system for Orchard Homes Irrigation Company and Missoula Irrigation District be conducted. It is important to consider combining diversions versus improving the individual systems as it is likely superior for aesthetics, recreational activities, safety and cost.

Since these upper two diversion sites are within the area of the Riverfront Plan it is important that MCCD and the companies formalize a relationship with the Missoula Redevelopment Agency which will facilitate communication and the coordination of activities along this stretch of the river. Beyond improving communication regarding riverfront activities, such an association could lead to funding assistance of district/company sponsored recreation and/or aesthetic improvement projects by the Redevelopment Agency. A similar arrangement should be made with the Missoula Parks and Recreation Department, in order to ensure that matters of mutual interest involving public safety and maintenance are properly addressed.

The means of formalizing such agency relationships should be developed by the respective staffs and then presented to the respective boards. Already, for example, the MRA staff has indicated an interest in attending MCCD Board meetings, especially those involving riverfront activities. Also, the MCCD Board has stated its desire to developing a relationship with MRA.

In addition, the District could assist the companies with a public education program which includes preparation and dissemination of a one or two page flyer with basic information about the irrigation facilities for general distribution. Such a campaign would be timely, for example, prior to any in-river work by either the District or the companies. Such information could be disseminated to the media and made available to the City and County to be included in general mailings with tax bills, etc.

Appendix A

Site Photos



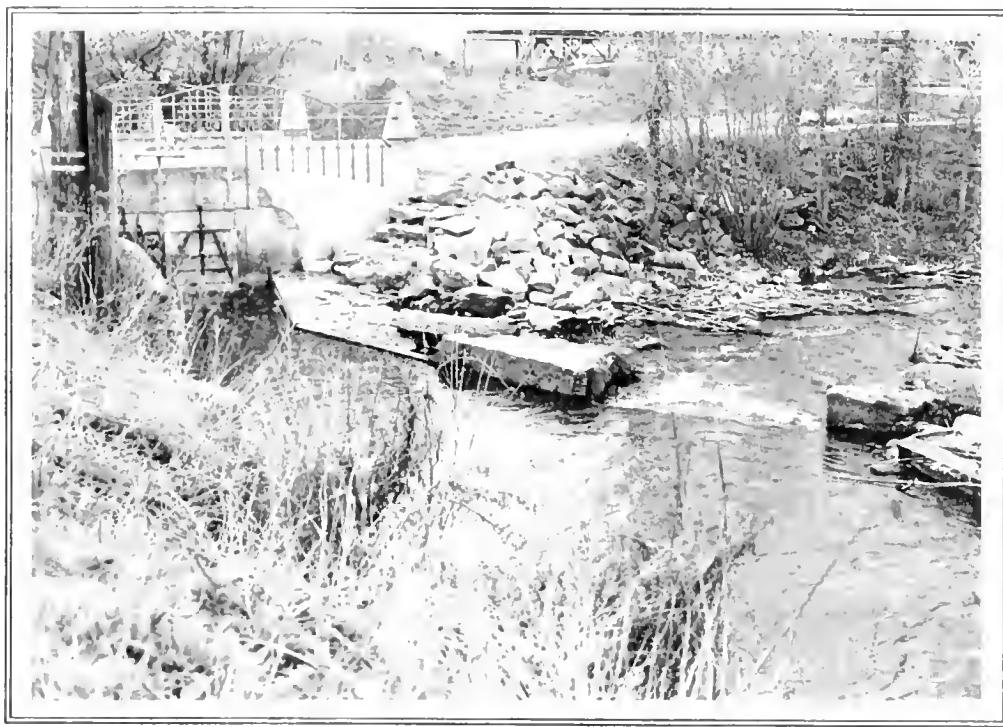
Missoula Irrigation District - Irrigation Diversion Structure



Missoula Irrigation District - Intake and Bypass Structures



Orchard Homes Irrigation Company
Irrigation Diversion and Approach Channel



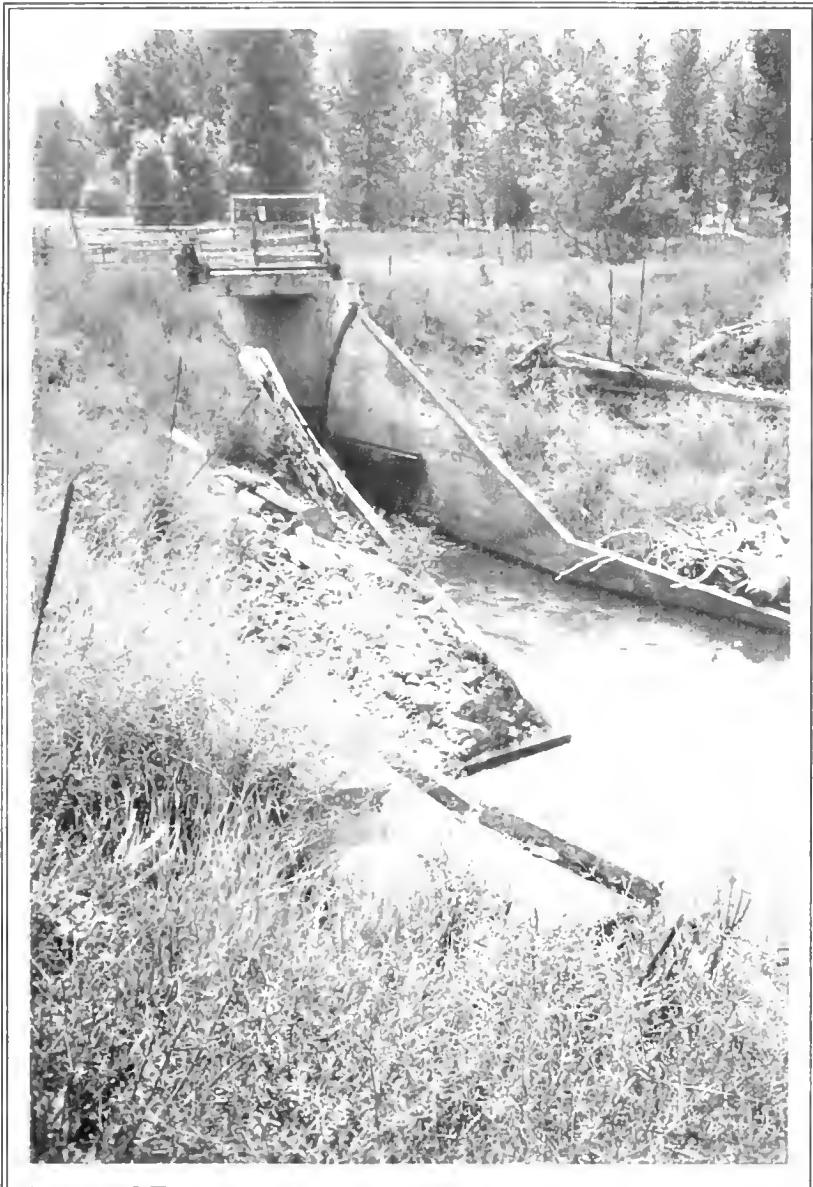
Orchard Homes Irrigation Company
Intake and Bypass Structures



Hellgate Irrigation Company
Irrigation Diversion Structure



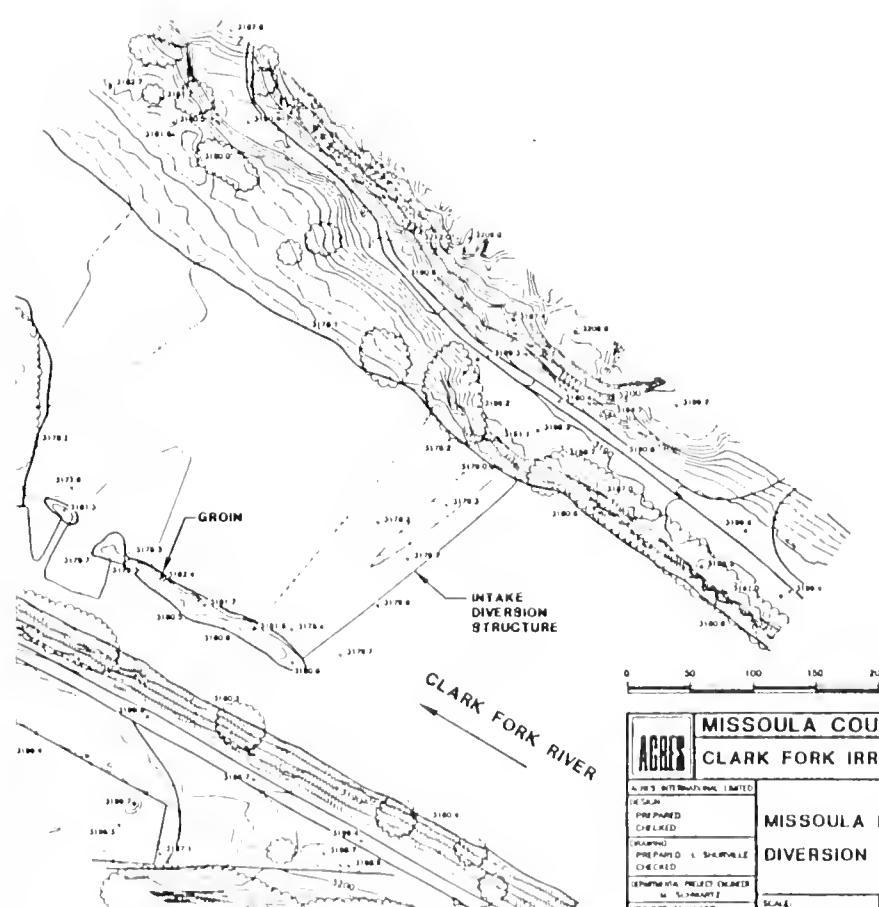
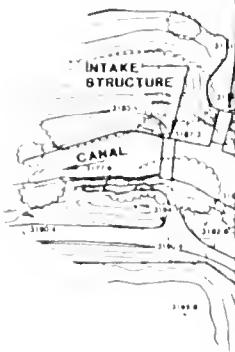
Grass Valley - French Ditch Irrigation Company
Irrigation Diversion Structure



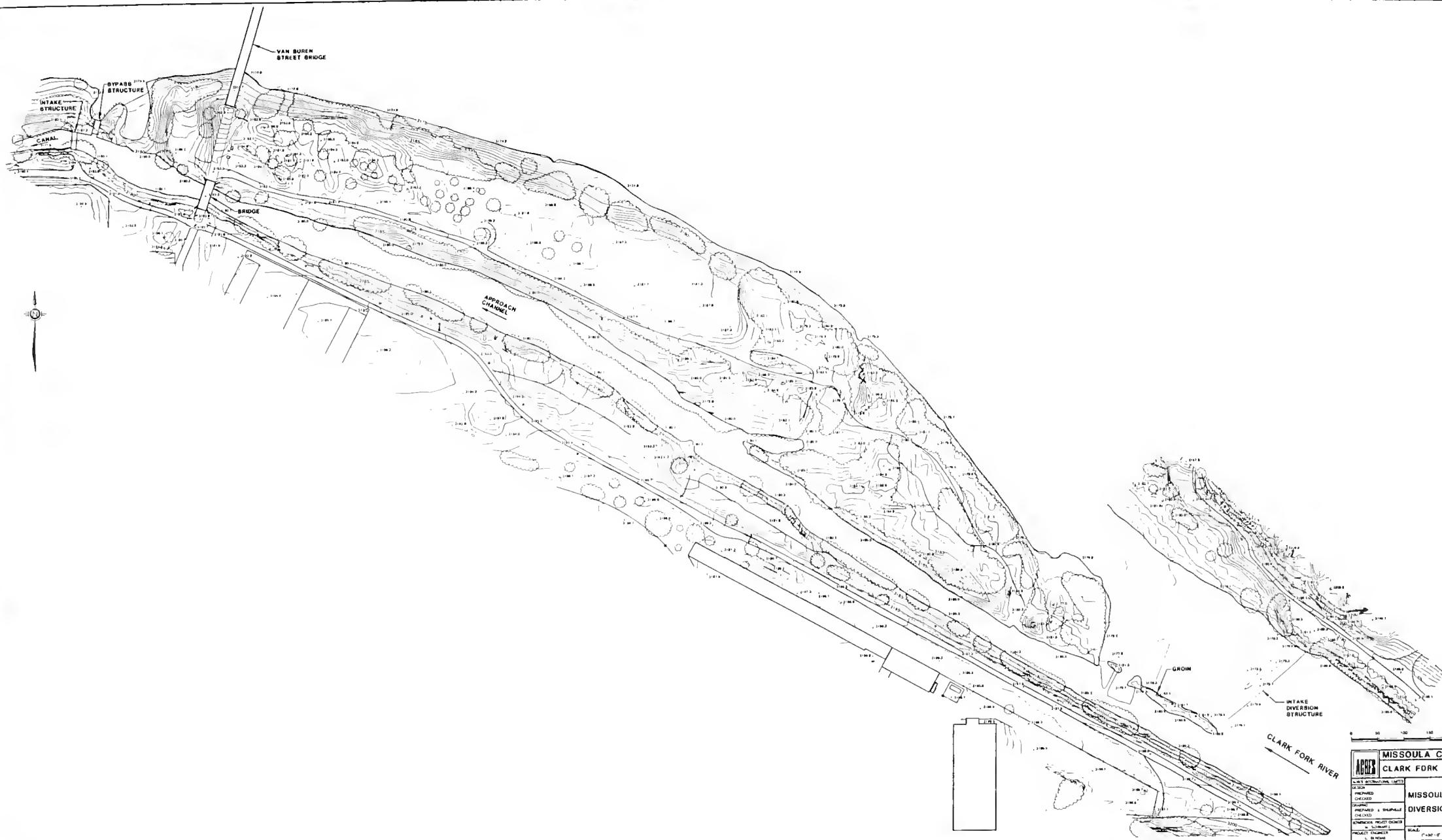
Frenchtown Irrigation District
Bypass Structure

Appendix B

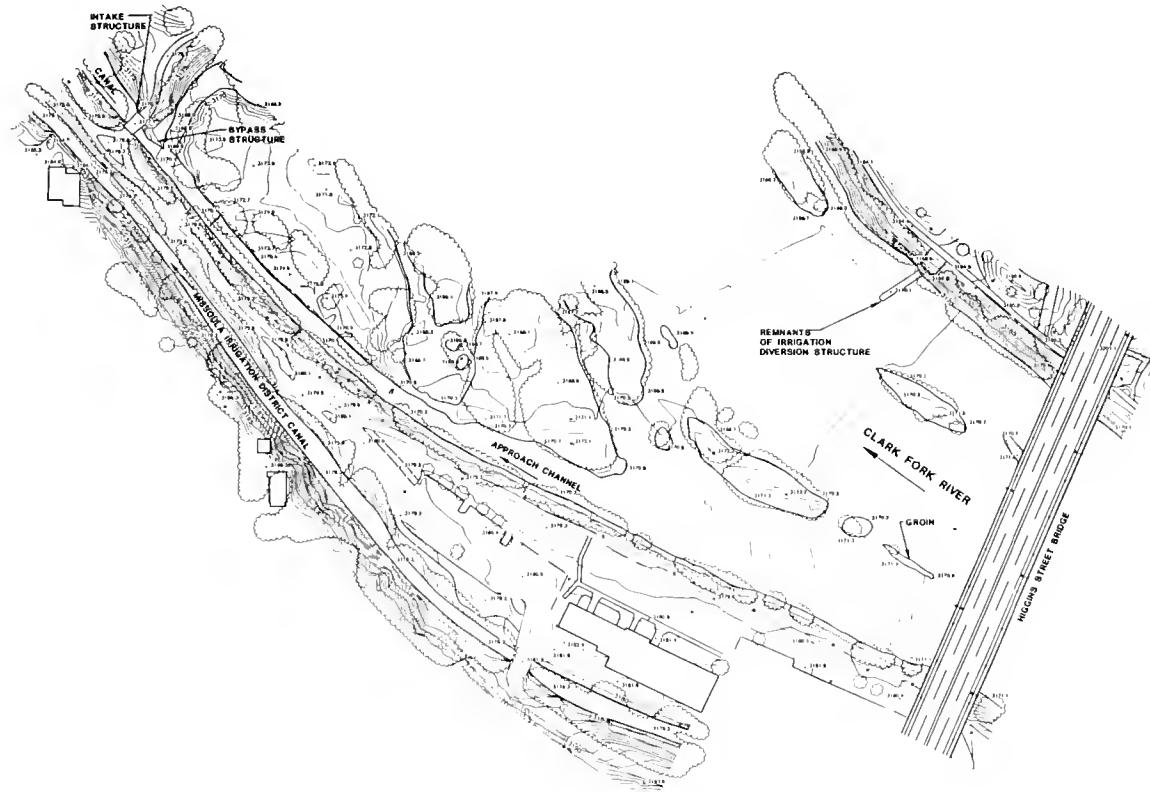
Site Maps



ACRES		MISSOULA COUNTY CONSERV. DIST.	
		CLARK FORK IRRIGATION DIVERSIONS	
ACRES INTERNATIONAL LIMITED		MISSOULA IRRIGATION DISTRICT	
DESIGN		DIVERSION FACILITIES	
PREPARED			
checked			
WARNING			
PREPARED: L. SHERVILLE			
checked			
DEPARTMENTAL PROJECT DIRECTOR			
M. SCHWARTZ			
PROJECT ENGINEER			
B. HANAN			
PROJECT MANAGER			
G. ALEXANDER			
SCALE: 1" = 80' 0"		DRAWING NO.	
		C-E-002	
		ALRES PROJECT NO.	
		P11372	
		Sheet	



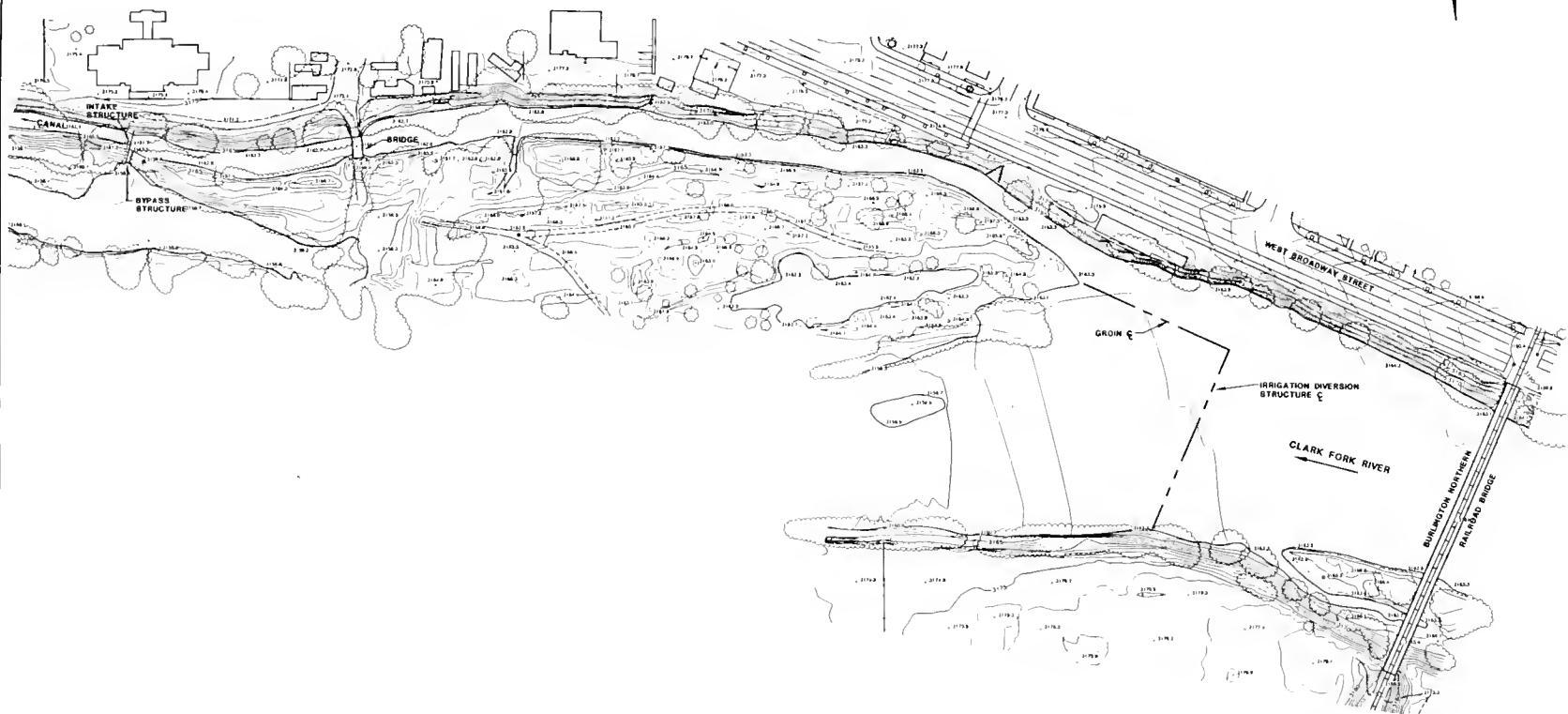
ABER	MISSOULA COUNTY CONSERV. DIST.	
	CLARK FORK IRRIGATION DIVERSIONS	
LAST INTERNAL UNIT		
PREPARED		
EXPIRED		
PREPARED & APPROVED		
DIRECTOR, PROJECT DIRECTOR		
MISSOULA IRRIGATION DISTRICT		
DIVERSION FACILITIES		
PROJECT NUMBER	NAME, FIRM, F/C	DIVISION NO.
PROJECT NUMBER	NAME, FIRM, F/C	REV.
PROJECT NUMBER	NAME, FIRM, F/C	C-E-002
PROJECT NUMBER	NAME, FIRM, F/C	SHEET



NOTE
WARNING BASED ON ACTUAL PHOTOCOPYING
(AUGUST 2, 1995)

0 30 100 130 200

ARCHER		MISSOULA COUNTY CONSERV. DIS.	
CLARK FORK IRRIGATION DIVERSIONS			
400' INTEGRATION LIMITS			
DUE TO PERMIT CHANGES			
DRAPE CLARK FORK		1. DRAPE CLARK FORK IRRIGATION DIVERSION FACILITIES	
PROJECT NUMBER A-100000		SCALE 1" = 50'-0"	
PROJECT NUMBER E-100000		DRAWING NO. C-A1-003	
ACRES PROJECT NO. 1.00000		SHEET	



NOTE
MAPPING BASED ON AERIAL PHOTOGRAPH
(AUGUST 1965)

0 50 100 150 200

MISSOULA COUNTY CONSERV. DIST.	
CLARK FORK IRRIGATION DIVERSION	
ALTES INSTITUTIONAL LIMITED	
DESIGN REVIEWED CHECKED	MANUFACTURE PREPARED & DRAWN CHECKED
REVIEWED & DRAWN N. SCHWARTZ	
PROJECT ENGINEER L. L. HARRIS	PROJECT MANAGER D. ROBERTS
SCALE 1:20,000	GRAPHIC NO. C-E-001
MISSOURI PROJECT NO. 50072	

ACRES